NSW GOVERNMENT | Trade & Investment

GUIDELINES

SSAI No 1
Accident Westcliff Colliery
29 July 1991

March 1993

Note: This publication has been produced electronically with original content as published by Mineral Resources NSW in 1995.

Produced by Mine Safety Operations Branch

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MINERAL RESOURCES

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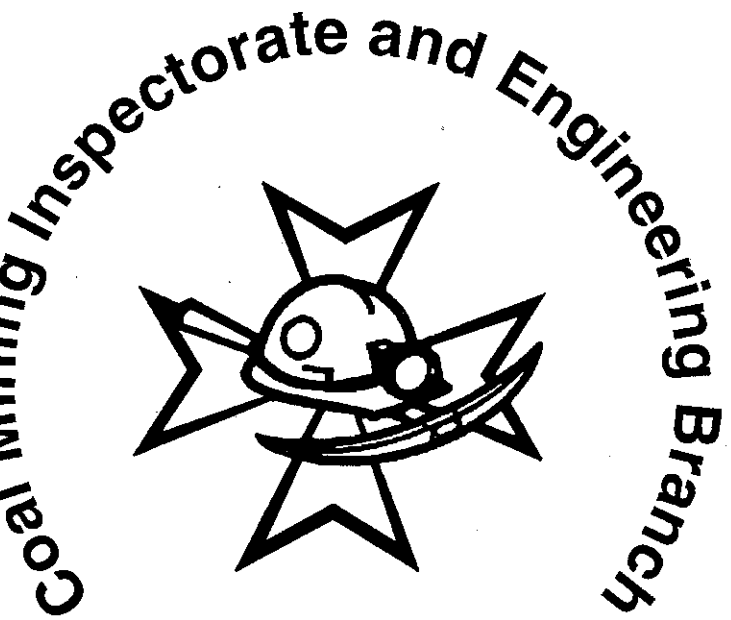
New South Wales



SYSTEM SAFETY ACCIDENT INVESTIGATION SUMMARY

ACCIDENT
WESTCLIFF COLLIERY
29 JULY 1991

MDG 3002

SSAI SUMMARY No. 1

DEPARTMENT OF MINERAL RESOURCES
NEW SOUTH WALES

COAL MINING INSPECTORATE

SYSTEM SAFETY ACCIDENT INVESTIGATION SUMMARY

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Foreword

In 1991 the Coal Mining Inspectorate of the New South Wales Department of Mineral Resources adopted a methodology for accident investigation known as System Safety Accident Investigation (SSAI). This has been employed since that time to form the basis for the investigation of fatalities and more serious accidents occurring in the coal mining industry in New South Wales.

SSAI consists of an accident investigation framework based on a number of 'tools'. These tools allow an investigation team to systematically examine: events and conditions related to an accident; management systems in place at the time of an accident; the transfer of damaging energy in the accident situation together with examination of in place or potential barriers to that energy flow; and certain behavioural aspects of those involved in an accident.

The team may also formulate a 'Team Management Standard' which comprises steps the team recognises as desirable to plan, organise, direct and control operations similar to those in an accident situation. This 'Standard' may be used to identify improvements desirable in the accident scenario and provide an audit tool for evaluation of other similar operations.

The structured nature of information arising from SSAI processes makes it a potentially very valuable tool for others to use in assessing operations which may be similar to those examined in an investigation.

In order that some positive outcome may result from what are otherwise distressing incidents, the Coal Mining Inspectorate is distributing summaries resulting from SSAI's which it has conducted. This is being done with a recognition that accidents result from failures in systems rather than unsafe acts of individuals and is intended to be an information transfer to industry of lessons learned in the course of investigations.

Those with a particular interest may obtain a full copy of the SSAI report on which this summary is based by contacting the team leader identified herein.

Bruce McKensey
Chief Inspector of Coal Mines
March 1993

OVERVIEW

PRECIS OF ACCIDENT

On Thursday, 29 July, 1991, at approximately 11.30 am an Undermanager suffered a severed right arm (above the elbow), a fractured left femur, a fractured pelvis and internal injuries when he was struck by a runaway Domino Myne Buggy which propelled him into and under the rear of a stationary Domino PET.

The Myne Buggy had been left unattended at the top of a 1:7.4 gradient when it suddenly rolled down the gradient. The PET was parked in the roadway at the bottom of an underpass formed for a belt conveyor whilst the load of pipes being transported was being resecured.

CIRCUMSTANCES

The undermanager with two (2) others had travelled from pit bottom in the Myne Buggy for purposes of conducting pre-shift inspections. Whilst at the longwall it was decided to drive a PET outbye which had been loaded with pipes that had been retracted during the previous shift.

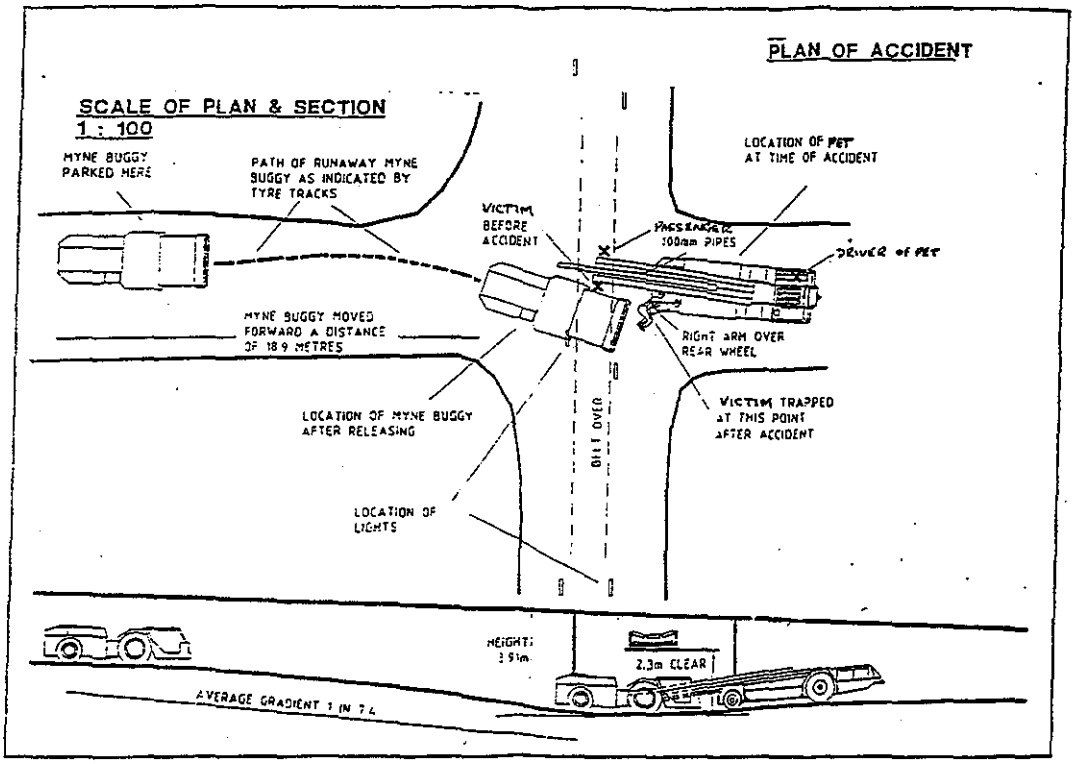
The length of the PET material carrying compartment was 4 m and the 6 m pipes overhung the rear of the vehicle by approx. 2 m.

The two (2) vehicles travelled outbye in convoy with the PET leading and the undermanager driving the Myne Buggy. When the PET travelled down the gradient in the roadway located at the belt underpass, the overhung pipes contacted the ground which caused them to become dislodged. The driver repositioned the pipes and was proceeding to drive the PET forward when the Myne Buggy arrived at the top of the grade leading down to the underpass. The distance between the vehicles being approx 20 m.

The PET proceeded to travel outbye but only moved 2 m when the pipes caught on the ground and started to become dislodged again. The driver stopped the PET and the undermanager with his passenger alighted from the Myne Buggy with the engine left running and went to assist the driver of the PET.

After the pipes had been repositioned for the second time the PET was about to proceed forward again. Whilst the undermanager and his passenger were observing this operation the Myne Buggy moved forward down the grade and subsequently struck the undermanager from behind projecting him violently into and under the rear end of the stationery PET.

For pictorial representation of accident refer the drawing over page.



INVESTIGATION

Thorough assessment and testing of the Myne Buggy could not identify any malfunction with controls or equipment which could have contributed to the vehicle running away.

The controls on the vehicle are designed to incorporate automatic application of the park brake on initiation of the engine shutdown switch.

The area in the vicinity was well lit and the roadway surface was good.

It would appear that the Myne Buggy had been parked at the top of the grade with the engine running and without the park brake applied.

SYSTEM SAFETY ACCIDENT INVESTIGATION

An investigation by the Department of Mineral Resources, Coal Mining Inspectorate was conducted as a System Safety Accident Investigation (SSAI). This method of investigation was originally developed by the United States Department of Energy and makes use of a number of `tools' to examine events and conditions related to an accident, management systems in place at the time of the accident, and the adequacy or otherwise of barriers (possible or in place) to prevent unwanted energy flows in the accident situation.

Findings (or inferences) from each of these tools are then grouped by related subject matter and these groups of findings form a basis for the drafting of `Judgements of Needs'. Judgements of Needs are a means used to identify areas for development of engineering controls or management systems to mitigate personal injury or damage in operations similar to those of the accident situation. Judgements of Needs are intended to identify but not replace the development of such controls or systems.

The investigation team consisted of:-

L. ROBERTS - Senior Inspector of Mechanical Engineer (Facilitator, Team Leader)
J. CONLON - District Inspector of Coal Mines
R. HOERNDLIEN - District Inspector of Mechanical Engineering
P. DEGRUCHY - Senior Technical Officer

SSAI OUTCOMES

The investigation resulted in a number of Judgement of Needs with only those of relevance for all the mining industry reproduced below. In addition, the team produced a number of observations and guidelines with the intention of identifying hazards associated with the type of operation involved in the accident to provide other mines with a means to assess similar operations.

JUDGEMENT OF NEED # 1

General Issues: **TRANSPORT RULES.** Areas of Implication: **Security of Loads and Maximum Loads.**

JUDGEMENT OF NEEDS:

A. There is a need for Management to review the current Transport Rules to ensure provisions for safe load transportation.

B. Revised Transport Rules to be subject to a review by use of feedback system.

C. Consideration to be given to special equipment transport needs eg. loading, carrying and installing pipes.

D. Eliminate unnecessary grades.

Related Findings:

1. Include requirements as per Clause 6 "Transport Regulations".
2. Existing Transport Rules do not address:-
(a) Securing loads and driver's responsibility for loads.
(b) Loads within envelope of vehicle's load area, also height gauges.
3. Plan mentioned in Clause B, 1(u) for speed or weight limitations on vehicles is not included in existing Transport Rules.
4. Clause B, 4(e) No "Rules" given in Transport Rules.
5. Engine running when vehicle is stationary. When engine is required to be turned off and when not? "Unattended" in Transport Rules needs to be defined.
6. Transport Rules do not mention roadway housekeeping.
7. Transport Rules do not mention towing trailers or u/s vehicles.
8. Transport Rules do not mention treatment of special loads.
9. Unnecessary grades formed by cutting floor for belt crossings (underpasses).

Discussion of Findings:

Clauses 2, 5, 8. and 9 are related to the accident the other clauses did not relate to the accident but emerged from the "Change Analysis".

All future belt crossings should be "overpasses" not "underpasses".

JUDGEMENT OF NEED # 2

General Issues: **VEHICLE DESIGN.**

Areas of Implication:
(a) Automatic Application of Park Brake.
(b) Remove Human Element.

JUDGEMENT OF NEED:

A. There is a need to review the design of F.S.V.'s to ensure automatic application of park brake when driver leaves vehicle, thus providing a second barrier not relying on the human element.
B. There is a need to review location and operation of controls to prevent accidental engagement.
C. There is a need to provide a barrier to separate F.S.V. driver from his load to prevent injury during collisions.

Related Findings:

1. Park brake should apply automatically when driver leaves vehicle.
2. Position controls to prevent accidental bumping.
3. Position controls to prevent accidental selection.
4. Position engine stop button to be within easy reach of driver's seat.
5. Driver protection from load during collision.
6. Park brake and F.N.R. control direction contrary to F.S.V. Guidelines.
7. Brake Performance:-
(a) Service Brake - under F.S.V. Guidelines standard.
(b) Park Brake - complies.
8. Neutral / Start interlock was faulty, (could remain in gear).
9. "Apply park brake when leaving vehicle" sign not attached to Buggy.

Discussion of Findings:

1. Reliance on human factor to engage park brake ie. this was the only barrier.

2. Possibility when "Neutral" selected, Buggy remained in Drive.

3. Possibility mistakenly engaged gear lever instead of park brake.

4. Driver may have stopped engine if stop button was closer.

5. Driver of P.E.T. may have been injured if Buggy crashed into pipes.

6. All related findings with the exception of Clauses 5 and 7 were related to the accident.

JUDGEMENT OF NEED # 4

General Issues: **TRANSPORT RULES S.101** **TRAINING RULES ORDER 34**	Areas of Implication: **ALL N.S.W. UNDERGROUND COAL MINES**

JUDGEMENT OF NEEDS:

A. There is a need for all N.S.W. Coal Mines to review and update Section 101 Transport Rules and Section 103 scheme. Most schemes have not been updated since 1984.

B. There is a need to eliminate unnecessary grades on transport roads.

Related Findings:

1. Instructions for transporting special loads should be included in Transport Rules.

2. There should be instructions for loads and special loads incorporated in all Transport Rules.

3. Documentation of Appointments and Training of Drivers should be kept up to date.

4. There are alternatives to cutting floor out and creating unnecessary grades.

Discussion of Findings:

1. and 2. Overhanging pipes were a contributing factor, but no provision was made in the Transport Rules.

3. Documentation of Appointments and Training were found to be incomplete.

4. To eliminate grades caused by cutting out floor for "underpasses", future belt crossings should be cut out of roof ie. "overpasses".

JUDGEMENT OF NEED # 5

General Issues: **STATE WIDE F.S.V. DESIGN CHANGES**	Areas of Implication: **HAND BRAKE, CONTROLS AND DRIVER PROTECTION**

JUDGEMENT OF NEEDS:

A. There is a need to incorporate an Automatic Park Brake on all F.S.V.'s which activates when Driver leaves the vehicle.

B. There is a need to review the ergonomics and safety of driver controls.

C. There is a need to review the protection for a driver from his load on all F.S.V. material transporters.

Related Findings:

1. All F.S.V.'s require a hard barrier (non-human) to prevent a runaway when driver is not on board, when engine is:-

   (a) Running

   (b) Stopped.

2. Controls on all F.S.V.'s shall be ergonomically designed to address:-

   (a) Accidental engagement - selection / bumping eg. selection of gear in lieu of park brake.

   (b) Location of engine shutdown.

   (c) Direction of controls (review F.S.V. Guidelines).

3. Protection of a driver from his load in the case of a collision.

Discussion of Findings:

1. Without this alteration is only one barrier and it relies on the human element.

2. The location of the controls of the Myne Buggy was unsatisfactory.

3. If the Buggy had hit the pipes the P.E.T. driver could have been injured.

GUIDELINES

The following recommendations were made by the investigation team as guidelines to assist underground mines assess the adequacy of the system and equipment used for transportation of men and materials by means of Free Steered Vehicles.

A. Transport Rules:

1) Plan required to define:

   (a) Minimum width and height of roadways
   (b) Maximum loads with respect to weight, number, etc. carried in or towed by vehicle.
   (c) Areas where speed is restricted.
   (d) Roadways for transportation of persons, loads.

2) Transport Rules to address:-

   (i) Material Loads.

   (a) Securing of loads - system and driver's responsibility.
   (b) Size of load, vehicle capacity (tyres), contain within envelope of load area, limited by height gauges.
   (c) Design vehicle for loading, transporting, unloading and installation of load.
   (d) Design load as packaging not single item handling.
   (e) Use of power lift assist?

   (ii) Special Loads.

   (a) Special provisions to be made if load overhangs back or sides of load area.
   (b) Maximum overhang to be limited in any case.
   (c) Some loads may require the road to be dedicated during period of transportation.
   (d) Certain loads may require a "Shunter".
   (e) Redesign vehicle to suit the load.
   (f) Provision to be made for towing u/s vehicles and trailers.

   (iii) Roadways.

   (a) Minimum roadway lighting and housekeeping standards.
   (b) Speed limit signs to be quantitative e.g. 5kph max.
   (c) Grades to be specified or signs e.g. 1:8.

   (iv) Vehicle Operation.

   (a) Parking of vehicles covering chocking of wheels, turning wheels to rib, application of park brake.
   (b) Conditions whereby vehicle is classified as unattended when driver not onboard and engine left running.

B. **Vehicle Design:**

(i) Eliminate potential for vehicle to runaway when left unattended with engine running to either extend automatic application of park brake to cover this situation or physically impair driver from leaving vehicle without park brake applied.

(ii) Controls:-

(a) Protect against bumping by driver or passenger.
(b) Inadvertent operation by driver - using wrong control by mistake.
(c) Operation of controls during impact.

(iii) Engine stop - to be within reach of driver's seat.

(iv) Protection to be provided for driver from material loads being projected into the driver compartment as result of collision with other vehicle or rib.

(v) Fit label in driver's compartment "Apply Park Brake when leaving vehicle".